Using Video Streaming

Setting up a Cheap System for Distributing Information to Teachers and Students

Video streaming can be a very useful tool for educators. It is now possible for a school's technical specialist or classroom teacher to create a streaming server with tools that are available in many classrooms. In this article we describe how we created our video streamer using free software, older computers, and borrowed hardware. The system works remarkably well, and the only cost was the time involved in building the unit.

The Need

Over the past few months, the Deaf Education PT³ Join Together project began investigating the use of videoconferencing and streaming video as a means of delivering information about new ideas in the field of deaf education. Two questions were identified as primary to the topic. Can videoconferencing be used to reduce isolation and bring the best teachers to preservice students? Can it be done at a price that is affordable to most schools and colleges? One of the most enthusiastic professors, Dr. Harold Johnson, Kent State University (KSU) Deaf Education Teacher Preparation Program, has created a project to answer these questions.

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Internet Videoconferencing

The Join Together project is using IP (Internet Protocol) videoconferencing to establish a network of deaf-education educators. To accomplish this goal, the project has awarded more than 80 Polycom ViaVideos and approximately five ViewStations to deaf and hearing educators and teachers of the deaf/hard of hearing across the United States. Recipients are using these systems to communicate with both speech and sign language over video.

The project group decided to use IP videoconferencing because of its portability, ease of set-up, and affordability. "Low tech, high impact" is what Johnson has been telling everyone. Use the most affordable, easy to use, entry level tools

that can have the biggest effect on student learning. The power of technology can be brought to the people who need it the most.

The majority of deaf-education educators working with the project have received Polycom ViaVideos. Deaf-education educators are able to collaborate with colleagues and students with this system. The camera is connected to a computer that has Internet access and uses the computer's IP address to make and receive calls. The Polycom ViaVideo has a useful share feature that makes it possible for two systems that are in a conference to share their desktops and any application that is running on that desktop. Deaf-education educators in the project have used this feature to videoconference and share slide shows and documents at the same time.

By using two inexpensive videoconferencing cameras with a projector, we have created a portable (camera connected to a laptop) videoconferencing system that works amazingly well when both sites have broadband connections.

Increasing Audience through Video Streaming

After successfully completing approximately a half dozen videoconferences, Johnson asked, "How can we open these virtual seminars to more people? The subjects covered in our videoconferences are of great value to the deaf education community, and more people should see them. Is it possible to share this information with a larger group of deaf-education students and educators?"

A multipoint videoconference was considered, but the project team decided against it because everyone would need a video system with a video bridge or multipoint control unit to participate. An easy and inexpensive way to include a larger group in the videoconferences was needed.

Our system uses a reconditioned computer with video card, a scan converter, and a ViaVideo camera connected to a laptop.

Streaming the video seemed to be a possible solution. Creating streaming video requires a powerful computer with encoding software; however, to view the video stream, all that is needed is a computer with an Internet connection and Windows Media Player. This would open up videoconferences to a larger number of students and instructors.

The project team inquired at companies that specialize in video streaming technologies and explained the plan. They were asked how much it would cost to put together a system that would stream a videoconference. The companies said it would not be a problem. They had systems that would meet the project's needs. After hearing the price though, there was a problem—the price of the system!

Creating Our Own Video Streamer

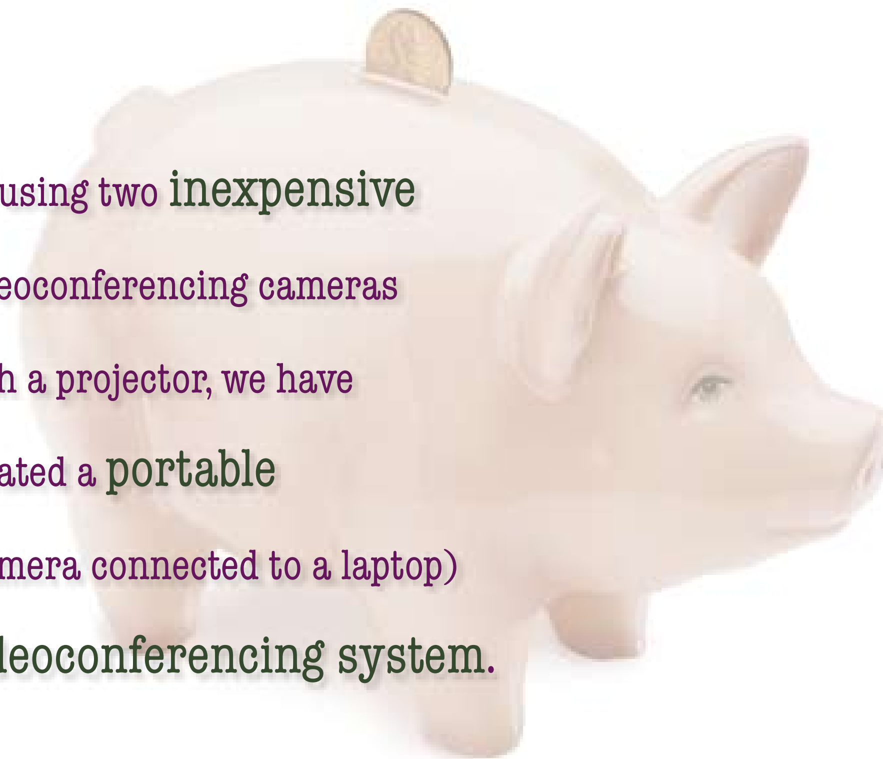
Co-author Landon Kearns and fellow KSU technology specialist Jason Wearley were consulted regarding the cost problem. They confirmed that a system could be created from tools and equipment located on campus. It would not be as pretty as the turnkey models, but it would get the job done.

The system has essentially three components:

- laptop running ViaVideo
- encoder PC
- streaming server

Audio and video from the ViaVideo application have to be captured and encoded for streaming. The capturing and encoding is done by a separate computer (called the encoder PC) using a video capture card and the Windows Media Encoder application. Because the Osprey brand video capture card installed in the encoder PC did not accept a VGA video feed, the VGA signal from the laptop had to be converted to an S-video signal with a Scan-Do Pro II scan converter. VGA video from the laptop was split using a splitter box to route video to both the scan converter and the video projector used to display the event to the classroom. Audio was routed directly from the laptop's line-out jack to the encoder PC's audio line-in jack. This configuration presented a problem. The local audio from the ViaVideo's internal microphone (when Johnson spoke) was not sent from the laptop's lineout, and therefore was not encoded or streamed. An external desktop microphone was added to the laptop that enabled local audio to be sent to the encoder PC.

Some audio settings in the ViaVideo and the laptop had to be adjusted to limit the chance of feedback and echo using the external micro-



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phone. As with the video projector for local video viewing, speakers had to be attached to the encoder PC to provide sound locally. Correct placement of the speakers is essential for feedback reduction.

We installed and configured Windows Media Encoder on the encoder PC. With help from KSU's streaming server administrator, Wearley, and a lot of trial and error, we finalized the encoder settings (e.g., resolution, bit rates, codecs, and so on) and created an encoding template. KSU supports streaming video technologies and maintains a Windows Media Server for faculty wishing to provide streaming video content. This streaming server can be reached any time from anywhere in the world over the Internet. A static link was established from the server to the encoder PC over KSU's IP network, and a URL was created for the resulting video stream. The outcome was that someone in Chicago, for instance, types this URL into their Windows Media Player and their computer begins decoding a downloaded stream of information from the media server on the KSU campus. The server, in turn, is looking at the encoder PC to provide the encoded audio and video information. The encoder PC is taking live audio and video from the ViaVideo application running on Johnson's laptop. All of these hops create approximately 15 seconds of delay from the time Johnson says something at KSU to when it's heard on the Internet.

Alternatively, if a dedicated, standalone streaming server cannot be acquired, the encoder PC can be set up to act as a light-duty streaming server. In this capacity, depending on the power of the encoder PC, Internet users can access the encoded stream directly from the encoding PC, assuming the encoder software is properly configured. The number of users that can be served this way depends greatly on PC power, bandwidth, and encoder settings.

The project's system was built entirely from equipment found on campus. The computer is a reconditioned 733 MHZ Pentium III, and the video card and scan converter are borrowed. The encoding software and information such as system requirements are freely available at Microsoft's Web site

(http://www.microsoft.com/windows/windowsmedia/9series/encoder/sysreq.aspx).

Results and Future Directions

The participants in each of the three virtual topical seminars were required to complete a survey after viewing the video stream. Each seminar had an average of 20 viewers. The survey asked questions such as: Was content appropriate for the subject area? Did the technology perform adequately? Did you experience any difficulties with the video stream? Participants were also asked to submit an overall rating of the experience on a scale of 1 to 5 with 5 being excellent. Their answers, their overall scale rating, and their comments suggested that the seminars were a positive experience for most of the viewers. The average rating overall was 4.1.

Everyone is pleased with the system's performance, as it did everything the project required. We were able to stream a live videoconference with Johnson while he was in a conference with a colleague. Viewers of this presentation were able to see it with only a 10–15-second delay. The presenters were able to take e-mailed questions and answer them on the air. In the future, the project would like to archive the streams for viewing at a later date. An encoder PC with more processing power and RAM will be needed to accomplish this goal. Virtual Topical Seminars have been so successful that the project decided to continue to increase the numbers of seminars during the 2004–05 year.

Streaming video turned out to be a very useful tool for the project. Information is passed to project members in a form they can use. It is not as expensive or as difficult as expected, and it is a great way to communicate with a large number of people in many different locations at the same time. A system such as ours can be assembled for less than $1,500.

Videoconferencing and streaming may reduce the isolation of students and instructors and give preservice students the ability to observe some of the best teachers in their classroom. Educators can collaborate with their colleagues or students from across the country. Preservice students can observe a teacher at work from many miles away. Hundreds of students and instructors can participate in videoconferences at the same time over the Internet.

Although our example is set in a university environment, it can easily be used in a K–12 school setting. Challenges and problems still remain, but streaming video is proving to be an affordable and effective educational tool.

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Landon Kearns has worked as a LAN support specialist for Kent State University for three years where he functions as the videoconferencing network and systems administrator. He received his bachelor's degree in aeronautical systems engineering technology from Kent State University's School of Technology in 2001 and is currently pursuing his master's in technology.